Influence of sedimentological variation on reservoir and source rock characteristics in shale dominated cyclothems (Campine Basin, NE Belgium)

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The KB186 well (GSB 047W0264, Lommel-Kerkhoven) is situated in the northern part of the Campine Basin (NE Belgium) to the west of the Donderslag fault and has been studied and sampled in detail from a depth of 1182.72 meters to 1197.75 metres. The objective is to examine the sedimentological, petrographical, mineralogical and petrophysical characteristics and their variations within and between two cyclothems. 17 shale samples were taken throughout the entire section, varying from roof shales, over dark organic-rich shales with siderite enrichments, to bluish-grey shales without no visible organic content.

Two sedimentary cycles have been recognised. Macroscopically, they show some similarities and differences in facies and sedimentological trends. Both are approximately 6.5 metres thick and contain sections of mainly shale deposits (with or without siderite enrichments). Fining-upwards sequences of fine sand and clayey silt and larger sandstone bodies occur between these shale-rich sections.

A petrographical assessment by means of optical light and electron microscopy is conducted for a qualitative analysis of the mineralogical composition and diagenetic history, while a quantitative determination is made by means of x-ray diffractometry. Important mineralogical reservoir parameters are the relative amounts of silica and quartz, and the clay mineralogy with special attention to smectite and illite.

Variations within and between the sedimentary cycles in reservoir and source rock characteristics are further examined by means of geochemical and petrophysical techniques. The Rock-Eval method yields information on source rock quality, such as hydrocarbon generation potential and thermal maturity. The reservoir potential of the deposit depends also on the amount of natural gas that can be stored in the rock as free gas in the pore spaces or as sorbed gas on the surface of clay and organic particles. Low-pressure sorption of CO_2 and N_2, helium pycnometry and mercury injection porosimetry (MIP) provide detailed information pore volume and pore structure. High-pressure methane sorption isotherms are measured to assess the sorption capacity.

We will demonstrate to which degree reservoir properties relate to sedimentological and/or diagenetic characteristics, a relation that when extrapolated can be used to make basin scale projections.